INNOVATION PERFORMANCE AND THE DEVELOPMENT POTENTIAL OF INNOVATION CLUSTERS AT THE LEVEL OF LAGGING-BEHIND REGIONS IN CENTRAL AND EASTERN EUROPE

Associate Professor Ph.D. CRISTINA GĂNESCU
"Constantin Brâncoveanu" University of Piteşti, Romania
Email: cristina_ganescu@yahoo.com
Associate Professor Ph.D. SEBASTIAN ENE
"Constantin Brâncoveanu" University of Piteşti, Romania

Abstract:The present study establishes the relationship between the innovation performance of enterprises in the lagging-behind regions in Central and Eastern Europe and the regional potential for development of innovation clusters. It assesses performance in innovation at the level of lagging-behind regions in Central and Eastern Europe, based on the 2019 Regional Innovation Scoreboard. The development potential of innovation clusters shall be determined on the basis of the Cluster Stars indicator (European Cluster Observatory). The results of the study highlight a positive link between innovation performance and the development potential of innovation clusters. Regions with a greater number of innovation clusters, but also those that have a higher potential for developing these clusters, enjoy greater innovation performance. Innovative organisations that are part of these clusters stimulate all cluster members to develop their innovative practices and new products/services.
Key words: innovation, innovation performance, innovation clusters, lagging-behind regions, Central and Eastern Europe.
JEL Classification: O10, R11.

1. Introduction

The European Union aims to support smart and sustainable growth and create conditions for supporting innovation, reasonable use of resources and valorisation of knowledge.

It is not surprising that regions that are economic leaders in Europe also perform strongly in innovation (Blazek and Kadlec, 2018, p.16). Moreover, small and medium-sized enterprises, through their high flexibility, can have greater innovation potential compared to large firms. When innovation is concentrated in a single large firm, it is possible to show "creative myopia", that inability to look around, to learn from others (Foray and Goenaga, 2013, p.8).

The aim of this research is to highlight the relationship between regional innovation performance and the potential for the creation and development of innovation clusters, at the level of lagging-behind regions in Central and Eastern Europe.

In section 2, it is analysed the literature on innovation concepts and innovation clusters. Section 3 assesses innovation performance based on the centralisation of Regional Innovation Scoreboard 2019 values. Section 4 establishes the existence of a positive correlation between innovation performance and the potential for development of innovation clusters. The paper concludes with a section of conclusions.

2. Innovation systems and innovation clusters

"Innovation is to an increasing extent grasped as an interactive and evolutionary process. Due to its complexity, single firm – especially small and medium-sized enterprises (SMEs) – are supposed to innovate in cooperation with other firms which enables all partners to optimally use own internal knowledge resources and to combine them with specific competencies of their partners" (Muller and Zenker, 2001, p.2).

Different types of innovation have different types of determinants, thus, disaggregating them is important (Figueiredo, 2018, p.24). For example, Edquist (2005)

appreciates that there is a difference between process innovation and product innovation. He clarifies that while product innovations relate to what is being produced, process innovations concern how they are produced. While goods and technological innovations are tangible, services and organizational ones are intangible.

While innovation studies highlight its effect at a micro-economic level, studies on innovation systems highlight the macroeconomic dimension of innovation and its effects on the whole economy (Figueiredo, 2018, p. 32).

The existence, in the literature, of a vast number of publications on this issue makes it difficult to define innovation systems. Innovation systems can be defined as "all important economic, social, political, organisational, institutional and other factors that influence the development, diffusion and use of innovation" (Edquist, 2005, p.182). "Innovation systems can have a national, regional, sectoral or technological dimension (Koschatzky et al., 2014, p.6). They might also be related and interwoven in the form of supra-national and interregional as well as combinations of spatial, sectoral and technological innovation systems (Fromhold-Eisebith, 2007; Markard and Truffer, 2008). Lundvall (1992, p. 2) describes an SI as a "system constituted by elements and relationships which interact in the production, diffusion and use of new and economically useful knowledge".

The innovation process may be seen as an intricate interplay between micro and macro phenomena where macro-structures condition micro-dynamics and vice versa new macro-structures are shaped by micro-processes. In a dynamic context this means that we need to understand systems as being complex and characterized by co-evolution and self-organizing (Lundvall, 2007, p.101).

Business associations are part of creating innovation systems, establishing research-development funding policies, supporting technological development and innovation (Koschatzky et al., 2014, p.13). From the experience of some German associations, the functions of regional innovation systems are structured in several categories, and support for research and innovation has an important role (Koschatzky et al., 2014, p.14):

Table no. 1. Functions in regional innovation systems (derived from experiences in Germany)

Type	Function
Association of companies	Lobbying, representation, participation, selfregulation
Chambers of Commerce and Industry	Services for member firms (e.g. training, qualification, seminars, advice & consultancy, information, events) Regional economic policy Lobbying, representation
Trade Unions	Participation of employees Labour conditions and wages Safeguarding of facilities
Employers association	Organisation of common interests of its members vis-a-vis the trade unions (e.g. wage bargaining) and policy (pressure-group function) Representation and enforcing of member interests Support of members (e.g. information and training activities)
Publicly or privately funded cluster initiatives and networking organisations	Advice and consultancy, information Networking and matching activities, events Regional strategies and self-organisation *Innovation and R&D support* Knowledge and technology transfer Public relations Internationalisation

Public promotion agencies	Safeguarding regional industry's competitiveness Industrial location support Provision of infrastructure (e.g. industrial real estate, spaces for start-ups, incubators) Cluster and network support Advice and consultancy, information
Business clubs and similar associations	Informal networking Humanitarian and social activities (health, education, conflict prevention, economic development) Cultural projects
Innovation councils	Policy advisory board Formulation of visions and objectives for *innovation policy* Elaboration of cross-departmental solutions Policy recommendations
Regional conferences & initiatives	Consensus building Participation, stakeholder process Formulation of statements for *innovation/regional policy*
Research associations	Organising cooperative research projects

Source: Koschatzky et al., 2014, p.14.

The innovation performance of the lagging-behind regions in Central and Eastern Europe is a concern for researchers. Thus, Blazek and Kadlec (2018) analysed the relationship between the research base, the research-development structure and the performance in innovation. This research highlighted that there are differences between European regions; thus, in advanced regions, private and public investment in research – development or a relatively balance between private and government is prevailing; in the lagging-behind regions, the structure is opposite.

Innovation develops in a conducive framework, conferred by the innovation clusters themselves. These are those interconnected networks of businesses, suppliers, institutions, universities, local and regional authorities that promote innovation and economic growth at regional level. An important role is held by producers using high technologies and holding research centres, universities and public authorities concerned (Timotin, 2016). The lifecycle of a cluster depends on its ability to support innovation.

3. Assessment of innovation performance, at the level of lagging-behind regions in European Union

The present paper aims to assess the innovation performance, at the level of the lagging-behind regions in the European Union, and to establish the relationship between the innovation performance of small and medium-sized European enterprises and the potential Regional development of innovation clusters, in different areas of activity.

In the first phase, the less developed regions of Central and Eastern Europe were identified, from Bulgaria, Croatia, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and Slovakia. Thus, the list of the 53 lagging-behind regions in Central and Eastern Europe was created.

For the evaluation of innovation performance, Regional Innovation Scoreboard (RIS) was studied (Hollanders, Es-Sadki and Merkelbach, 2019). This report, drafted by the European Commission, provides a comparative assessment of the national innovation systems for 238 regions in 23 member states, Norway, Serbia and Switzerland. Similar to the European Innovation Scoreboard (EIS), where countries are classified into four innovation performance groups, Europe's regions have been classified into similar groups of regional Innovation Leaders (38 regions), regional Strong Innovators (73 regions), regional Moderate innovators (97 regions) and regional Modest Innovators (30 regions) (Hollanders, Es-Sadki and Merkelbach, 2019, p.4).

The RIS methodology takes up the EIS methodology, used to measure performance at national level, and uses 17 of the 27 indicators of the EIS 2019. The data was available at the level of 2017 for six indicators, at the level of 2016 for ten indicators and at the level of 2015 for an indicator. In addition, a revision of the NUTS classification resulted in the change in the number of regions for France (from 9 to 14), Hungary (from 7 to 8), Ireland (from 2 to 3), Lithuania (from 0 to 2) and Poland (from 16 to 17).

For the present research, the value of the RIS 2019 was chosen. The data for the "Sales of new-to-market and new-to-firm innovations" indicator refers only to small and medium-sized enterprises, not to all companies. There is a lack of data for Estonia and Latvia, which leads to their elimination from the list; this leaves 51 regions left behind for evaluation. The results achieved led to a ranking of the lagging-behind regions, in Central and Eastern Europe, in terms of innovation performance (Table no. 2).

Table no. 2. Innovation performance index of the 51 lagging-behind regions, in Central and Eastern Europe

No. Crt.	Region	RIS 2019
1.	LT01 - Sostinės regionas	90.5
2.	CZ05 - Severovýchod	88.7
3.	CZ06 - Jihovýchod	85.0
4.	CZ03 - Jihozápad	82.4
5.	PL36 - Warszawski stoleczny	82.4
6.	HU12 - Pest	81.5
7.	CZ07 - Strední Morava	80.1
8.	CZ02 - Strední Cechy	79.5
9.	CZ08 - Moravskoslezsko	78.7
10.	SI03 - Vzhodna Slovenija	73.9
11.	PL21 - Malopolskie	73.4
12.	LT02 - Vidurio ir vakarų Lietuvos regionas	68.4
13.	HR04 - Kontinentalna Hrvatska	61.2
14.	PL34 - Podkarpackie	61.0
15.	PL30 - Pomorskie	60.4
16.	CZ04 - Severozápad	60.1
17.	PL26 - Dolnoslaskie	59.7
18.	SK04 - Východné Slovensko	59.7
19.	SK02 - Západné Slovensko	58.6
20.	BG41 - Yugozapaden	56.8
21.	HU22 - Nyugat-Dunántúl	55.1
22.	PL31 - Lódzkie	54.9
23.	HU33 - Dél-Alföld	54.5
24.	SK03 - Stredné Slovensko	54,5
25.	PL22 - Slaskie	53.8
26.	HU21 - Közép-Dunántúl	53.4
27.	HU23 - Dél-Dunántúl	53.3
28.	HU31 - Észak-Magyarország	53.1
29.	HU32 - Észak-Alföld	52.0
30.	PL37 - Mazowiecki regionalny	49.2
31.	PL33 - Lubelskie	48.4
32.	PL32 - Swietokrzyskie	48.3

33.	PL28 - Kujawsko-Pomorskie	48.2
34.	HR03 - Jadranska Hrvatska	47.1
35.	PL35 - Podlaskie	45.4
36.	PL24 - Zachodniopomorskie	45.1
37.	PL27 - Opolskie	43.2
38.	PL25 - Lubuskie	42.9
39.	BG32 - Severen tsentralen	40.2
40.	BG42 - Yuzhen tsentralen	39.4
41.	BG33 - Severoiztochen	39.1
42.	PL29 - Warminsko-Mazurskie	38.7
43.	BG34 - Yugoiztochen	37.4
44.	RO42 - Vest	34.3
45.	BG31 - Severozapaden	32.6
46.	RO11 - Nord-Vest	31.1
47.	RO12 - Centru	28.6
48.	RO22 - Sud-Est	23.1
49.	RO21 - Nord-Est	22.5
50.	RO31 - Sud - Muntenia	19.3
51.	RO41 - Sud-Vest Oltenia	15.0

Source: Hollanders, H., Es-Sadki, N. and Merkelbach, I., 2019. *Regional Innovation Scoreboard*. Luxembourg: Publications Office of the European Union.

After innovation performance, some regions of Latvia, Czech Republic, Poland, Hungary are on first positions. We find that, unfortunately, the regions of Romania occupy the last places with the lowest level of innovation performance. This reflects the poor innovation orientation of the Romanian economy and the poor financing of research-development-innovation activities.

4. The relationship between innovation performance and the potential for creation and development of innovation clusters

For the analysis of the regions, from the point of view of the significant agglomerations of innovation clusters and the potential for creating innovation clusters, the European Cluster Observatory (European Union, 2018) was studied and opted for the Cluster Stars indicator. This is a composite indicator that takes into account four dimensions: Number of employees, Location coefficient, Labor productivity and Annual growth rate. A agglomeration receives a star if it is in the top 20% of the regions of the European Union for each of the four dimensions.

For this study, the values of this composite indicator were recorded at the level of each analysed regions (Gănescu, Şerbănică, Ene and Talmaciu, 2019). From the lack of data, the two regions of Croatia, the Pest region of Hungary, the regions Warszawski Stoleczny and Mazowiecki Regionalny in Poland, as well as the regions of Slovenia, were excluded from the analysis. They remained 45 regions in analysis.

Table no. 3. Regional innovation performance, Cluster Stars and GDP per capita

Nr. Crt.	Regiune	GDP per capita, 2017	Regional Innovation Scoreboard - RIS 2019	Cluster Stars - CS
1.	CZ06 - Jihovýchod	15400	85.0	55
2.	CZ02 - Strední Cechy	15300	79.5	49
3.	PL22 - Slaskie	11500	53.8	46
4.	PL26 - Dolnoslaskie	12300	59.7	44
5.	RO12 - Centru	8000	28.6	43
6.	BG41 - Yugozapaden	10900	56.8	42
7.	PL21 - Malopolskie	10100	73.4	42
8.	CZ08 - Moravskoslezsko	14300	78.7	41
9.	PL30 - Pomorskie	10700	60.4	40
10.	SK02 - Západné Slovensko	13900	58.6	40
11.	CZ05 - Severovýchod	13800	88.7	39
12.	CZ07 - Strední Morava	13600	80.1	38
13.	HU32 - Észak-Alföld	7400	52.0	36
14.	CZ03 - Jihozápad	14700	82.4	35
15.	RO42 - Vest	8900	34.3	35
16.	SK03 - Stredné Slovensko	11900	54.5	35
17.	SK04 - Východné Slovensko	10400	59.7	35
18.	PL34 - Podkarpackie	7900	61.0	34
19.	CZ04 - Severozápad	12000	60.1	33
20.	HU31 - Észak-Magyarország	7700	53.1	32
21.	PL28 - Kujawsko-Pomorskie	9100	48.2	32
22.	PL31 - Lódzkie	10400	54.9	32
23.	RO11 - Nord-Vest	7600	31.1	32
24.	HU33 - Dél-Alföld	8300	54.5	31
25.	PL24 - Zachodniopomorskie	9300	45.1	31
26.	BG42 - Yuzhen tsentralen	4700	39.4	30
27.	HU21 - Közép-Dunántúl	11000	53.4	30
28.	HU22 - Nyugat-Dunántúl	12700	55.1	30
29.	RO21 - Nord-Est	5300	22.5	30
30.	RO31 - Sud - Muntenia	6800	19.3	29
31.	HU23 - Dél-Dunántúl	7600	53.3	26
32.	RO41 - Sud-Vest Oltenia	6300	15.0	26
33.	PL32 - Swietokrzyskie	7900	48.3	23
34.	RO22 - Sud-Est	7400	23.1	23
35.	PL25 - Lubuskie	9300	42.9	22
36.	PL33 - Lubelskie	7600	48.4	22
37.	PL27 - Opolskie	8900	43.2	21
38.	PL29 - Warminsko-Mazurskie	7900	38.7	21
39.	BG34 - Yugoiztochen	5900	37.4	19
40.	BG31 - Severozapaden	4100	32.6	16
41.	BG32 - Severen tsentralen	4700	40.2	16
42.	BG33 - Severoiztochen	5400	39.1	16

43.	LT02 - Vidurio ir vakarų Lietuvos regionas	13500	68.4	16
44.	LT01 - Sostinės regionas	13500	90.5	15
45.	PL35 - Podlaskie	7900	45.4	14

Sources: Gănescu, C., Șerbănică, C., Ene, S. and Talmaciu, I., 2019. Innovation clusters, tools to promote and support regional smart specialization. *Management & Marketing*, volume XVII, issue 1/2019, pp.7-18; European Union, 2018. *European Cluster Collaboration Platform, Cluster Organisations Mapping Tool.* [online] Available at: <https://www.clustercollaboration.eu/cluster-mapping> [Accessed 5 July 2019].

The ranking according to Cluster Stars indicator highlights the presence, in the top ten, of regions in the Czech Republic, Poland, Romania and Bulgaria, which recorded a high score, respectively over 40 stars (Table no. 3). In these regions, there are important and potentially high agglomerations to create innovation clusters.

In order to highlight the relationship between regional innovation performance and the potential for the creation and development of innovation clusters, at the level of the lagging-behind regions in Central and Eastern Europe, the statistical correlation method was used. The value 0.419192 of the correlation coefficient between RIS 2019 and CS highlights the existence of a direct, positive, high-intensity link (Table no. 4).

Table no. 4. The correlation matrix between RIS and CS

	RIS	CS
RIS	1	0.419192
CS	0.419192	1

Therefore, there is a positive correlation between the regional innovation performance and the potential for the creation and development of innovation clusters.

Even if, in some lagging-behind regions in Central and Eastern Europe, there are innovation clusters or potential for developing innovation clusters in extremely dynamic areas, it is evident that it represents only a framework that can sustain the innovation performance. It is necessary, within these clusters, to have companies, institutions, universities or authorities to financially support research-development-innovation, to create and develop their research infrastructure, to use new technologies and performance. Only by supporting innovation, these innovation clusters can exist and can develop.

The correlation between GDP per capita and Cluster Stars, which has a value of 0.564261, shows the existence of a positive, medium-intensity relationship. Also, the value 0.825624 of the correlation between GDP per capita and RIS demonstrates the positive, strong relationship between the two indicators. Statistically, it is demonstrated that in regions where the level of development is higher, there are innovation initiatives, especially in the direction of innovation clusters.

5. Conclusions

The lagging-behind regions in Central and Eastern Europe have potential for development, and investment in research and development and in dynamic sectors is the solution of increasing and reducing disparities between the regions of the European Union. Innovation clusters influence regional growth by facilitating the implementation of innovations, reducing costs and applying modern technologies.

We appreciate that in the lagging-behind regions, innovation clusters are contributing significantly to regional development by discovering areas that can influence the growth of smart regional specialisation. Regions with a greater number of innovation clusters, but also those that have a higher potential for developing these clusters, enjoy greater innovation performance. Innovative organisations that are part of these clusters stimulate all cluster members to develop their innovative practices and new products/services.

The results of this study show the exisence of a positive relationship between the regional innovation performance and the potential for the creation and development of innovation clusters, at the level of the lagging-behind regions in Central and Eastern Europe. It is obvious innovation clusters are the framework for increasing the innovation performance of the regions.

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